SURVEY OF MYSTIC RIVER, MASS.

Syllabus

The district engineer is of the opinion that the existing project for Mystic River, Mass. should be modified in the interest of general navigation, practically as desired by local interests. He, therefore, recommends the deepening of Mystic River to a depth of 35 feet below mean low water over an area substantially as shown on the accompanying map, extending from the upper limit of the 35-foot channel of Boston Harbor at Chelsea North Bridge to the downstream side of the Malden Bridge, at an estimated cost of $2,286,300 for new work and $4,000 for annual maintenance, in addition to that now required. In view of the fact that the improvement will benefit general navigation, no cooperation in its cost by local interests is recommended.

War Department,
United States Engineer Office,
Boston 16, Massachusetts,
23 April 1946.

Subject: Survey of Mystic River, Mass.

To: The Chief of Engineers, United States Army (through the Division Engineer, New England Division).

1. Authority.- This report is submitted in compliance with Section 6 of the River and Harbor Act approved 2 March 1945 (Public Law No. 14 - 79th Congress) which reads in part as follows:

> "Sec. 6. The Secretary of War is hereby authorized and directed to cause preliminary examinations and surveys to be made at the following-named localities, ... , Mystic River, Massachusetts".

2. In accordance with the above authority, a preliminary examination of the locality was made, and the district engineer, in his report dated 18 September 1945, recommended that a survey be made. The division engineer and the Board of Engineers for Rivers and Harbors concurred in the views of the district engineer, and a survey was authorized by the Chief of Engineers under date of 30 October 1945.

3. Description.- The Mystic River rises in the Mystic Lakes, flows in a southeasterly direction for about 7 miles, and empties into Boston Harbor just above the Charlestown Navy Yard. It is tidal for about 5 miles

above its mouth to Cradock Bridge, Medford, the head of commercial navigation, where it is closed by a dam. The portions of the river above the dam are included in the metropolitan park system. No records of discharge are available. From the Chelsea North Bridge at the head of the 35-foot channel of Boston Harbor, Mass., to a point abreast of the mouth of Island End River, the controlling depth is 28 feet over a least channel width of 300 feet. From the mouth of Island End River to a point abreast of the city playground at Charlestown the controlling depth is 28 feet at mean low water over a channel width of 500 feet. From a point abreast of the Charlestown city playground to a point abreast of the entrance channel to the Monsanto Chemical Co.'s plant the controlling depth is 20 feet at mean low water, the controlling width being limited to 75 feet in the draw passages of the Charlestown-Everett bridges. At the upper end of the channel just described there is a turning basin 340 feet by 610 feet, with a controlling depth of 20 feet. From the head of the turning basin to the vicinity of Cradock Bridge, the head of commercial navigation, the controlling depth is 4 feet at mean low water in a narrow channel. At the dam at Cradock Bridge there is a boat lock 60 feet in length and 15 feet wide, a canoe rollway, automatic weirs that regulate the height of water above the dam, and electrically operated sluice gates for use when necessary. The dam is used to exclude tide water and to maintain the level of the river at a grade about 3 feet below mean high water, with a navigable depth varying from about 7 feet at the dam to about 4 feet at the lower Mystic Lake. The upper Mystic Lake and the Aberjona River up to Winchester are used to some extent for canoeing. The shores of the pool and the lakes are owned by the Commonwealth of Massachusetts and are operated by the Metropolitan Park Commission.

4. The mean range of tide in Mystic River is 9.6 feet and the spring range is 13.7 feet. The locality is shown on United States Coast and Geodetic Survey Chart No. 248, and on the map accompanying this report. The improvement considered in this report would result in no significant

changes in the shore line in this locality and no questions of water power, flood control, or other special subjects are involved.

5. Tributary area.- The Mystic River is bordered by the cities of Boston (Charlestown district), Somerville, Medford, Chelsea and Everett. In 1940 Boston had a population of 770,816; Somerville, 102,177; Medford, 63,083; Chelsea, 41,259; and Everett, 46,784.

6. The cities all have many and diversified industries, consisting of shoe manufacturing, printing, textiles, food products, foundry and machine shops, millworking, chemicals, woodworking, paper-box board, sugar refining, assembling automobiles, distilling gasoline, gas manufacturing, and various others.

7. The industries located along the Mystic waterfront are as follows: United States Gypsum Co.; Boston & Maine Railroad Co.; Revere Sugar Refining Co.; Wiggin Terminals, Inc.; Brockway-Smith-Haigh-Lovell Co.; Eastern Gas & Fuel Associates (Mystic Iron Works); Colonial Beacon Oil Co.; Monsanto Chemical Co.; Boston Elevated Railway; and Ford Motor Co. With the exception of the Ford Motor Co. these industries are located along the section of the river having depths ranging from 30 to 19 feet at mean low water.

8. The industries listed above are served by the Boston & Maine Railroad Co. which has spurs adjacent to or running onto the wharves. The area is served by an excellent system of improved highways. The section of the river above Wellington Bridge is navigable by small barges.

9. Bridges.- Seven bridges cross the improved section of Mystic River and one crosses the river at the upstream limit of the improved section. They would be passed in the following order by a vessel proceeding upstream:

Name	Miles Above Mouth	Owner	Type of Drawspan	Clearances Horizontal	Clearances Vertical
Chelsea North (highway)	0.12	Boston & Chelsea	Swing (2 openings)	125	22.6 m.l.w. 13.0 m.h.w.
Malden (highway)	1.44	Boston	Bascule	75	16.3 m.l.w. 6.7 m.h.w.
Boston Elevated Railway	1.44	Boston Elevated	Bascule	75	38.4 m.l.w. 28.8 m.h.w.
Boston & Maine Railroad (eastern division)	1.75	Boston & Maine RR	Jackknife Swing	42.6	6.1 m.l.w. -3.5 m.h.w.
Boston & Maine Railroad (western division)	2.0	Boston & Maine RR	Jackknife Swing	44	6.64 m.l.w. -2.9 m.h.w.
Wellington (highway)	2.5	Metropolitan Park Commission	Bascule	50	20.0 m.l.w. 10.2 m.h.w.
Mystic River (highway)	3.6	Metropolitan Park Commission	Bascule	50	14.5 m.l.w. 5.0 m.h.w.
*Cradock (highway)	5.06	Metropolitan Park Commission	Fixed		7.0 m.l.w.

*Above improved section of the waterway.

10. The proposed improvement would not entail alteration of any of the existing bridges. At the hearing, attention was called to the possibility of the Chelsea North Highway Bridge becoming an unreasonable obstruction to navigation at some future time.

11. Prior reports.- There have been no reports on Mystic River during the past five years.

12. Existing project.- Prior to the adoption of the existing project (expenditures on which began in 1910) the original project, authorized by the River and Harbor Act of March 3, 1899, was for a channel 25 feet deep at mean low water and 300 feet wide from the mouth of the river in Boston Harbor, about 1 mile below Chelsea North Bridge, to a point 800 feet above the mouth of Island End River. This project was modified by the River and

Harbor Act of June 25, 1910, by providing for the abandonment of the proposed 800-foot extension above the mouth of Island End River. The project as modified was completed in February 1911 at a cost of $125,723.20. In addition, $10,281.92 was spent for maintenance.

13. The existing project for the Mystic River provides for a channel 30 feet deep downstream from the mouth of Island End River, through the Chelsea North Bridge to the 35-foot channel of Boston Harbor, about one-half mile, 600 feet wide at the upper end, and gradually narrowing to 300 feet wide at the lower end, and widening of the entrance channel leading to Mystic Wharf; a channel 30 feet deep and 500 feet wide upstream from the mouth of Island End River to the city playground at Charlestown; a channel 20 feet deep from the head of the existing 30-foot channel to a point 800 feet above the Malden Bridge with widths decreasing from 270 feet at the lower end to 75 feet through the drawspan, thence increasing to approximately 340 feet to form a turning basin above the bridge; a channel 6 feet deep and 100 feet wide from the Boston & Maine Railroad (western division) Bridge to about 2,500 feet above Wellington Bridge, about 1 mile, and thence 4 feet deep, gradually narrowing from 100 feet to 50 feet at the upper end for about 2 miles to the head of commercial navigation at Cradock Bridge in Medford. The project depths refer to mean low water.

14. The existing project was completed in 1940 with the completion of the 20-foot channel in the vicinity of Malden Bridge. The 30-foot channel extending from the 35-foot channel in Boston Harbor to the mouth of Island End River was completed in 1914, and the extension of this channel upstream to the city playground at Charlestown was completed in 1938. A channel in the upper Mystic with project depths of 6 and 4 feet was completed in 1906.

15. The total costs under the existing project have been $818,169.09, of which $770,125.12 was for new work and $48,043.97 was for maintenance. The latest (1938) approved estimate of cost of annual maintenance is $7,500.

16. The existing project was authorized by the following River and Harbor Acts:

Acts	Work Authorized	Documents
July 13, 1892	Improvement of Upper Mystic.	A.R. 1891, p. 672.
June 25, 1910	Improvement of channel downstream from mouth of Island End River to 35-foot channel of Boston Harbor.	H. Doc. No. 1086, 60th Cong., 2d sess.
Aug. 30, 1935[1]	Improvement of channel upstream from mouth of Island End River to city playground at Charlestown.	R.& H. Com. Doc. No. 33, 74th Cong., 1st sess.
June 20, 1938[2]	Improvement of channel upstream from city playground at Charlestown to 800 feet above Malden Bridge.	H. Doc. No. 542, 75th Cong.,3d sess.

1. Also Emergency Relief Act of 1935.
2. Contains latest published map.

17. Local cooperation.- There have been no prescribed conditions of local cooperation or cash contributions toward Federal improvements.

18. Other improvements.- The Commonwealth of Massachusetts has expended $514,026.75 for improvements in the Mystic River. The work accomplished has consisted of dredging a channel from 200 to 500 feet wide and 30 feet deep at mean low water on the southerly side of the river, from about 300 feet above the Chelsea North Bridge to the vicinity of the playground in Charlestown. A channel 900 feet long, 100 feet wide, and 30 feet deep at mean low water has been dredged at the Colonial Beacon Oil Co.'s wharf just above the entrance to Island End River. A channel from 75 to 300 feet wide and 16 feet deep at mean low water was dredged through the Malden Bridge from the upper end of the 30-foot channel abreast of the city playground at Charlestown to abreast of the entrance channel leading to the wharf of the Monsanto Chemical Co. on the Everett shore. This channel was later deepened to 20 feet as a Federal project. Local interests have contributed $69,182.50 toward this work.

19. In addition to the work done by the Commonwealth, the Monsanto Chemical Co. has dredged a berth at its wharf about 1,000 feet long, 150

feet wide, and from 18 to 25 feet deep at mean low water. The Eastern Gas & Fuel Associates (Mystic Iron Works) has dredged a channel on the Everett shore, from the Beacon Oil Co.'s wharf to its own wharf, about 2,000 feet long, 100 feet wide and 30 feet deep at mean low water.

20. Terminal and transfer facilities.- There are fifteen piers and wharves on the Mystic River, five of which provide 6,587 linear feet of berthing space with 30 feet of water alongside; five provide 2,512 linear feet with depths of from 25 to 28 feet; and five provide 3,456 linear feet with depths varying from 7 to 22 feet.

21. The principal terminals on the Mystic River are those belonging to the Wiggin Terminals, Inc., the Revere Sugar Refining Co., the Boston & Maine Railroad Co., the New England Coal & Coke Co., the Eastern Gas & Fuel Associates (Mystic Iron Works), the Monsanto Chemical Co., and the Colonial Beacon Oil Co.

22. Of the three wharves belonging to the Wiggin Terminals Inc., two are used for the receipt and storage of lumber. They are the largest of that kind in New England, being equipped with modern mechanical handling facilities and depths of 30 feet. The third is used for handling general cargo in foreign and domestic trade. Both Revere Sugar Refining Co. wharves are used for the receipt and refining of raw sugar. The Boston & Maine Railroad Co. wharf and that of the New England Coal & Coke Co. are used for the receipt and storage of coal. The Eastern Gas & Fuel Associates (Mystic Iron Works) wharf is used for the receipt of ore and limestone. The Monsanto Chemical Co. wharves are used for the receipt of bauxite, molasses, sulphur, and chemicals, and the Colonial Beacon Oil Co. wharf is used for the receipt and shipment of petroleum products. All of the above wharves have modern equipment for handling cargo and railroad connections with the Boston & Maine or Boston & Albany Railroads. Of the five remaining wharves, one is used for the receipt of gypsum rock and fuel oil, one for the receipt and

storage of sand and miscellaneous equipment, one for the receipt of petroleum products, and two are not in use.

23. Four of the fifteen facilities on the Mystic River are above the limits of the 30-foot channel, two of which belong to the Monsanto Chemical Co. and have depths of 18 and 25 feet, one is owned by the Boston Elevated Railway Co., with depths of 9 to 12 feet, and the other is leased by the Crown Gas & Oil Co. and has a depth of 7 feet at mean low water.

24. There are two wharves on Island End River, a tributary of the Mystic River which enters the Mystic between the Chelsea and Malden Bridges. One of these is used for handling coal, coke and pig iron and has a frontage of 970 feet and a depth of 27 feet, and the other is not in use.

25. There are four wharves on the Malden River, a tributary of the Mystic River which enters the river above the Boston & Maine Railroad (eastern division) Bridge. One has a depth of 15 feet and is used for the receipt of bulk tar, one has a depth of 6 feet and is used for the shipment of scrap iron and metals, and two, with depths of 6 feet and 1.5 feet, are not in use.

26. Improvement desired.- In order to afford local interests an opportunity to express their views relative to the improvement of Mystic River, a public hearing was held at the United States Engineer Office, Boston, Mass., on 6 June 1945. The report on preliminary examination together with transcript of hearing, exhibits presented, map and other pertinent papers, were submitted to the division engineer 18 September 1945. Among those present were representatives of the Massachusetts Department of Public Works, Cities of Boston, Medford, and Somerville, the Maritime Association of the Boston Chamber of Commerce, the Boston Edison Co., the Boston Consolidated Gas Co., the American Merchant Marine Institute, the Boston & Maine Railroad Co., the Propeller Club of Boston, coal, oil and towboat interests, and owners and managers of facilities bordering on that portion of the river under consideration.

27. The improvement desired by the proponents is the deepening of Mystic River channel to 35 feet at mean low water for its entire width, from Chelsea North Bridge to the Charlestown playground, thence to Malden Bridge for a width extending from the southerly line of the present 20-foot channel to near the Boston Edison Co. bulkhead. This area has a project depth of 30 feet to the Charlestown playground and 20 feet from there to Malden Bridge. Part of it was dredged by the Federal Government and the remainder, including the portion locally referred to as the Middle Ground, was dredged by the Commonwealth of Massachusetts. Particular attention was called to the necessity for removing the rocky area north of the 30-foot channel between Chelsea North Bridge and Island End River in order to eliminate the sharp turn required in navigating the draw passage.

28. The oil interests were the most active participants in the movement for the improvement. The Standard Oil Co. of New Jersey (Colonial Beacon Oil Co.) and the American Merchant Marine Institute submitted detailed briefs in support of their contentions. They stated that there are 500 to 600 new T-2 type tankers to be placed in service after the war. These tankers are 523 feet long, have a capacity of 135,000 barrels and need a 35-foot channel for safe navigation, having a draft of 30 to 31 feet when loaded on an even keel and extreme draft of 32 to 33 feet when under way. The Standard Oil Co. of New Jersey has a fleet of 44 large tankers, 28 of which have mean drafts of more than 30 feet, and almost all the rest have from 28 to 30 feet.

29. Owners of wharves and terminals on the Mystic River were all in favor of the improvement and basically for the same reason. The new colliers will be of the C-M type built during the war, and lumber and other cargo will be shipped in Liberty and Victory ships. The Boston Edison Co. has two 50,000-kilowatt units in operation and another on order. Upon the completion of this expansion program, they desire to operate their

own collier and tanker unloading facilities and will need the 35-foot channel to their plant.

30. The Mayor of Medford requested that the navigable portion of the river upstream to the Cradock Dam be encompassed in the report and that some examination be made relative to its use for its most advantageous purposes, stating that they were interested in a dam whereby they could establish a fresh water basin down through Mystic marshland. He stated that a dam at Wellington Bridge would permit development of probably one-fourth of the area of the entire city which is flooded at high tide. It was his opinion that the initiation should come from the Federal Government since it controlled the river. The City Engineer of Somerville asked that his city be put on record as opposing any development that would impose any expense on them.

31. A representative of the Commonwealth of Massachusetts stated that he was authorized to pledge the cooperation of the Commonwealth as far as possible to any improvements to be made, but he could make no statement as to the financial contribution. In response to a question, he stated that the Commonwealth has already contributed a half million dollars to the improvement of the waterway.

32. Commerce.- The leading commodities in the commerce of Mystic River are coal and petroleum and its products. In 1945 these commodities comprised about 24% and 66%, respectively, of the commerce of the river. The remaining 10% consisted principally of gypsum, lumber, sugar, molasses and iron and steel. The following table gives a comparative statement of traffic. The figures since 1941 include only general commercial freight, as the figures on military shipments are not available.

COMPARATIVE STATEMENT OF TRAFFIC

Year	Tons	Tons Cargo in Transit (Malden & Island End Rivers)
1939	4,490,207	1,898,630
1940	4,792,769	2,022,807
1941	4,891,303	2,269,844
1942	2,317,804	1,954,975
1943	2,382,922	1,713,120
1944	3,371,521	2,073,813
1945	4,149,496	2,077,834

33. Vessel traffic.- The following table gives the trips and drafts of vessels using Mystic River in 1945:

Vessel Traffic[1]

	UPBOUND					DOWNBOUND				
Draft ft.	Stmrs.[2]	Motor Vsls.[3]	Barges[4]	Scows	Total	Stmrs.[2]	Motor Vsls.[3]	Barges[4]	Scows	Total
31		1			1					
30	11	2			13					
28 to 30	33	13			46					
26 to 28	63	15			78	1	1			2
24 to 26	62	3	2		67	8	1			9
22 to 24	22	1	16		39	10	4			14
20 to 22	45	3	5		53	23	2			25
18 to 20	39	1	18		58	41	4			45
16 to 18	14	1	28		43	66	16			82
14 to 16	9	20	27		56	47	9	1		57
12 to 14	7	14	1		22	56	22	10		88
Less than 12	3	514	1351	25	1893	56	529	1437	25	2047
Total	308	588	1448	25	2369	308	588	1448	25	2369
Total net registered tonnage	1,004,859	372,195	638,195	12,250	2,027,499	1,004,859	372,195	638,195	12,250	2,027,499

1. In addition, the vessel traffic of Island End River and Malden River passed through Mystic River.
2. Including 130 foreign.
3. Including 26 foreign.
4. Including 18 foreign.

NOTE.- In addition, there was traffic of United States Navy vessels of unknown draft to the main waterfront. This consisted of 97 round trips of Navy barges and 9 round trips of a mine planter.

The usual limits of draft for loaded vessels carrying the various commodities are as follows:

	Steamers	Motor Vessels	Towed Barges
Coal	14 to 30 ft.	14 to 15 ft.	8 to 24 ft.
Fuel Oil & Refined Petroleum Oils	15 to 31 ft.	5 to 32 ft.	3 to 14 ft.

34. Difficulties attending navigation.- The location of the drawspan of the Chelsea North Bridge and the alignment of the channel near the bridge makes it very difficult for a large vessel to pass through the north draw opening into the river and avoid striking the north bank. The projecting bank is largely ledge rock.

35. The lack of sufficient depth in the channel makes navigation at the lower stages of the tide extremely hazardous for vessels with drafts of 27 to 30 feet.

36. Survey.- A sounding survey of the area extending from the Chelsea North Bridge to the Malden Bridge was completed in 1946. Probings and borings were made to determine the amount and type of material to be encountered and to determine the extent of ledge rock. The accompanying map, marked "Mystic River, Massachusetts, File No. 346, Dr. 50", shows the latest soundings, probing and boring data, and other general features.

37. Plan of improvement.- The plan of improvement described below is the same as that desired by local interests, except that instead of dredging the entire width of Mystic River, the deepening will only extend to within 100 feet of the bulkhead line.

38. The plan considered herein consists of deepening the Mystic River channel to a depth of 35 feet at mean low water over the area shown on the accompanying map, extending from the upper limit of the 35-foot channel of Boston Harbor at Chelsea North Bridge to the downstream side of the Malden Bridge. In the estimate for dredging given below, the quantity is in terms of place measurement and provides for 2 feet of allowable overdepth. The price includes an allowance for engineering and contingencies and is based on the work being done by contract, with the disposal of excavated material at sea.

Dredging ordinary material, 2,007,000 cubic yards at 65¢	$1,304,550
Removing ledge rock, 128,280 cubic yards at $10.	1,282,800
Total	$2,587,350
Additional annual maintenance cost	$ 4,000

39. Aids to navigation.- No additional aids to navigation will be required for the improvement.

40. Analysis of economic justification.- The economic cost, as an annual carrying charge, for the proposed plan of improvement, has been estimated on a life of 40 years for the improvement. The analysis of cost is given below:

(1) Federal Investment:	
(a) Estimated cost of improvement by Engineer Department	$2,587,350
(b) Estimated cost of aids to navigation by United States Coast Guard	-0-
(c) Total Federal Investment	$2,587,350
(2) Federal Annual Carrying Charge:	
(a) Interest at 3% on Item (1)(c)	$ 77,620
(b) Amortization of Item (1) (a) (40 years at 3%)	37,309
(c) Increased cost of maintenance	1,000
(d) Total Federal Annual Carrying Charge	$ 115,929
(3) Non-Federal Investment:	
(a) Lowering of cables	$ 10,000
(b) Total Non-Federal Investment	$ 10,000
(4) Non-Federal Annual Charge:	
(a) Interest at 3½% on Item (3)(b)	$ 350
(b) Amortization of Item (3)(b) (40 years at 3½%)	118
(c) Total Non-Federal Annual Carrying Charge	$ 468
(5) Total Carrying Charge:	
(a) Federal annual carrying charge	$ 115,929
(b) Non-Federal annual carrying charge	468
(c) Total Annual Carrying Charge	$ 116,397

41. The direct benefits which would result from deepening the 30-foot channel and improving its alignment on the north side above the Chelsea North Bridge would be those resulting from a saving in time to the larger vessels using the waterway. Under existing conditions, vessels drawing 27 feet or more proceed upstream through the Chelsea North Bridge only at high water slack in daylight. These vessels, when proceeding downstream,

even though light, pass through the bridge only during daylight hours. The average delay to each vessel proceeding upstream is in excess of eight hours, while the average delay in proceeding downstream is three hours. The Standard Oil Co. of New Jersey (Colonial Beacon Oil Co.) estimates that in the first complete normal year's operation since the war, they will move about 13,433,000 barrels of petroleum to its Everett refinery. The company estimates the number of tanker trips required will be 110 and that the estimated value of the saving in time would be approximately $?21,000 if the improvement is made. The hourly rate used by the company is $100 an hour. In this connection, the tanker cost for T-2 tanker operation as contained in the publication "War-built Pipe Lines and the Post-war Transportation of Petroleum" by Sam G. Spal of the Bureau of Transport Economics and Statistics, Interstate Commerce Commission is $75 per hour while running, and $65 per hour standing. Savings from elimination of delay were computed in the above publication as between $65 and $67 per hour, on the basis of annual costs of tanker operation with various periods of delay. Using a rate of $67, instead of $100, the estimated saving would be $82,070.

42. In 1939 there were 359 vessels drawing 27 feet or more using Mystic River, while in 1940 there were 303 such vessels. Of these there were 210 in 1939 and 134 in 1940 that were not proceeding to the Colonial Beacon Oil Co. Using the smaller number, which is believed to represent a conservative estimate of the probable traffic of such vessels in normal times, the saving by elimination of delay to these vessels, based upon a rate of $50 an hour, would amount to $73,700. The total estimated saving for the tankers and other vessels would be $154,770 which amount is well in excess of the total annual carrying charges as set forth in paragraph 40. The ratio of benefits to charges is 1.33 to 1.

43. Discussion.- The Mystic River is one of the most important arms of the Port of Boston. According to the 1944 statistics, 30 percent of all water traffic in Boston Harbor is handled on this waterway. The waterfront area is well developed, with modern facilities for handling various types of cargo. It is believed that the widening and deepening of the 30-foot

channel would result in further development of the wharves and facilities along the Mystic River.

44. The Wiggin Terminals Inc., located on the south side of the river, is a privately-owned marine terminal and storage warehouse. Their lumber terminal is said to be one of the most efficient and up-to-date on the Atlantic coast. It has berthing space for three ships and is capable of handling 1,500,000 feet of lumber a day. During the war the United States Maritime Commission leased the lumber department for the installation of torpedo nets on Liberty ships. According to their records, four different ships went aground while maneuvering the channel. The Wiggin Terminals expect that in the postwar period Liberty and Victory ships will want to use their terminal, but with insufficient water in the channel, it will be impossible. This, they fear, will eliminate the use of their general cargo pier. At present their berths are dredged to 31 feet at mean low water.

45. The oil interests operate a fleet of tankers, most of which draw from 30 to 31 feet when loaded on an even keel. Under present conditions these vessels can operate only at high water slack during daylight hours. The Standard Oil Co. of New Jersey, whose local subsidiary the Colonial Beacon Oil Co. has a large refinery on the Mystic River, estimates that in the first normal year after the war they will move about 13,433,000 barrels of petroleum products to its Everett refinery. This will mean about 110 tanker trips a year. It is expected that these tankers will be of the T-2 type and draw about 30 feet of water. At present their berths are dredged to 31 feet at mean low water, but they stated that they will dredge them to 35 feet if the 35-foot channel is provided.

46. The Mystic power plant of the Boston Edison Co. now has two 50,000 kilowatt units in operation and a third is on order. As the capacity of the plant is increased, it will eventually be necessary for the Boston Edison Co. to provide its own collier and tanker unloading facilities, at which time the 35-foot channel will be necessary for tankers and colliers.

47. Shipping and towboat interests are of the opinion that the present 30-foot channel does not permit vessels to maneuver and navigate with freedom, in and out of Mystic River. At present, ships drawing more than 27 feet enter and leave Mystic River only at high water slack in daylight, and because of the channel alignment above the Chelsea North Bridge, large vessels, even though drawing less than 27 feet, wait for daylight before proceeding through the bridge. The principal cause of the delay to large vessels regardless of draft is the alignment of the north side of the channel above the bridge. With the proposed improvement to the alignment, this condition would be corrected and the delay due to this cause eliminated. The deepening of the channel is principally necessary to provide for the use of T-2 tankers which it is expected will soon comprise the major portion of the tanker fleets owned by the oil companies engaged in the intercoastal shipping of petroleum. With a 35-foot channel and the improvement of conditions in the vicinity of the Chelsea North Bridge draw passage, it would be possible to navigate the river at any stage of tide, either day or night.

48. Because of the conditions described in the previous paragraph, passage of vessels is limited to a daylight period extending from about two hours before to two hours after high tide. On this basis, in a mean lunar day of 24.95 hours, there would be a period of 20.95 hours during which a vessel would be delayed anywhere from a maximum of 20.95 hours down to no delay at all, or an average of 10.47 hours. As the probability of a vessel arriving during a period of delay is about .84, the average delay to all vessels under consideration is .84 x 10.47 hours, or 8.79 hours. The Standard Oil Co. of New Jersey estimates their saving in time resulting from the elimination of the condition causing the delay as eight hours per vessel which is within the limit computed above, and used in the calculation of benefits shown in paragraph 41.

49. The improvement of the upper Mystic and Malden Rivers and adjacent marshes has been under consideration by local governments for a number of years. In 1931 a report was made by the Metropolitan District Commission and the Massachusetts Department of Public Health on the subject of improving this area for recreational and other uses. The recommended plan, which has never been adopted, proposed the construction of a dam in the Mystic River at or near the eastern division bridge below the Malden River and the creation of a basin above, to be maintained with its surface at approximately 7 feet above mean low water. A lock would be provided in the dam sufficient for the requirements of navigation on the river, and dredging would be done to maintain the present depth of water for navigation. Another plan which was considered at the time, but not recommended, was for the construction of a similar dam at the Wellington Bridge. This is the plan to which reference was made at the hearing, by the Mayor of Medford. In view of the fact that the development is not proposed in the interest of navigation, the only concern of the Federal Government in the project is that suitable provisions for navigation be made by local interests if the plan is adopted.

50. There are cables crossing the Mystic River in two areas that would have to be lowered to get the 35-foot depth, one at the draw passage of the Chelsea North Bridge, and the other crosses the channel from the New England Coal & Coke Co. to the Eastern Gas & Fuel Associates.

51. The plan of improvement considered in this report is the same as that desired by local interests, except that the channel will extend to within only 100 feet of the bulkhead lines instead of the full width from bulkhead line to bulkhead line. As the width of channel considered is ample for maneuvering and navigating all vessels, it is believed the remaining dredging, which would largely be in the nature of providing berths, should be done by local interests. The savings to be secured from the improvement are those resulting from elimination of delays caused by lack of depth and poor alignment. The amount of the direct benefits was estimated in paragraph 42

as $154,770. The estimated annual saving, which exceeds the annual carrying charges, is sufficient to warrant the improvement. In view of the general benefits resulting from the improvement, no local cooperation is considered necessary.

52. Conclusion.- It is the opinion of the district engineer that the improvement of Mystic River, Mass., as described in paragraph 38 of this report, is adequate and necessary to meet the requirements of navigation and is justified by the benefits to be derived therefrom by general navigation.

53. Recommendation.- In view of the foregoing, the district engineer recommends that the existing project for Mystic River, Mass., be modified to provide for the deepening of the Mystic River, to a depth of 35 feet at mean low water, over an area substantially as shown on the accompanying map, extending from the upper limit of the 35-foot channel of Boston Harbor at Chelsea North Bridge to the downstream side of the Malden Bridge, at an estimated cost of $2,286,300 for new work and $4,000 for annual maintenance, in addition to that now required. As the proposed improvement is in the interest of general navigation, no local cooperation in its cost is recommended.

54. The work should be prosecuted at a rate to insure its completion in two years. An initial allotment of $1,300,000 should be made the first year and the balance the second year.

C. T. HUNT,
Colonel, Corps of Engineers,
District Engineer.

Inclosure:
Map